

*Office of Technical Assistance Research Proposal*  
***Sterilization of Cooling Tower Waters using Pulsed Electric Fields***

**BACKGROUND**

Previously we submitted a research suggestion based on the destruction of bacteria, algae and other microorganisms in beverages that would bypass the need for pasteurization. This idea was based on the fact that these organisms are polarizable and as such are subject to a possibly lethal force in a non-homogenous electric field. In the last five years there have appeared several articles confirming the efficacy of pulsed electric fields (PEFs) in this destructive role. A recent paper by Sato *et al.*<sup>1</sup> evaluates several arrangements of the electrodes that produce these PEFs in terms of their biodestructive and energy efficiency.

Sato et al. used a non-homogenous electric field. This type of field was used initially by early workers to cause motion of these one celled entities. However if a uniform field were used a higher and equal force would be experienced by each end of the polarized cell possibly causing destruction of the cell. This aspect should be carefully examined since it would lead to a greater efficiency of cell destruction.

Rather than apply this technique to beverage sterilization, we feel that a more significant environmental effect could be achieved by applying it to the treatment of cooling tower water. The waters in cooling towers are usually warm and exposed to the external air, conditions favorable to the growth of microorganisms. These can aggregate and form a “biofilm” which acts as a glue to bond hard water scale to heat exchange surfaces, vastly reducing cooling efficiency. Often times this difficulty is dealt with by treating the water with toxics such as biocides and algaecides. Implementation of PEFs could potentially eliminate this use of toxics.

Ozone has also been used in past years to replace toxics use in cooling towers, but there has been some concern regarding the enhanced corrosivity of the water using this technique.

**SCOPE OF PROBLEM**

Available data suggest that there are roughly 12, 250 cooling towers in Massachusetts that require chemical treatment. Approximately \$8-\$10 per ton of cooling capacity is spent on these chemicals. Taking a guess mean of 1000 tons as typical tower capacity, we can see that nearly \$100 million is expended in Massachusetts each year on this issue.

Aside from the considerable financial benefit, eliminating the use of these toxics is a clear step in source pollution prevention. Present environmental releases include blowdown wastewater and possible air emissions due to volatilization. Though there are many biocides and algaecides on the commercial market, it is possible to make a rough estimate of the total amount used each year of about 40 million pounds.

**PROGRAM OBJECTIVE**

A reasonable objective for a one-year project would be the development and demonstration of a bench model based on existing R&D of PEFs in the beverage industry, with sufficient testing data to determine its operational envelope and make a recommendation for further research. OTA can assist in the identification of an industry partner.

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<sup>1</sup> Sato et al., High efficiency sterilizer by high voltage pulse using concentrated field electrode system, *Proceedings of the IREEE/IAS Conference*; Rome, October 2000.